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THE EXCURSIONS OF THE GEOLOGICAL SOCIETY OF FRANCE FOR 1878.

BY E. D. COPE.

THE Geological Society of France, though well known in the United States as a publishing body, is not so well known as a school of experts who give practical instruction in their science. In their annual excursions they offer opportunities for acquiring special knowledge in geology of peculiar value. The present season the excursions were arranged in view of the presence of numerous foreigners for a limited time in Paris, so as to exhibit the geology of the country near to, or within easy reach of the capital. There were seven in all, and each one was in charge of a competent geological instructor, while the financial department was under direction of the indefatigable treasurer of the society, Dr. Bioche. A better opportunity of becoming acquainted with the standard of classification of the Tertiary formations which France furnishes to the world, could scarcely have been presented; while the series of beds of the Cretaceous and Upper Jurassic formations visited by the excursionists is, in many respects, very complete. The explanations on the ground furnished by the masters of the subject was all that could be desired for clearness and pains-taking. The leaders of the excursions were Messrs. Hèbert, Lapparent, Tournouer, Vèlain, etc. Among the excursionists we noticed, besides the resident members; M.M. DeWalck, Rutot and Lefevre, of Belgium; M. Stephanescu of Belgrade; M. Renevier, Lausanne; Prof. Guisgardi, Naples; Profs. Almera, Barcelona, and Eulate, Madrid; Fontannes, Lyons; Matheron and Saporta, Provence, and many others.

The first expedition was in the immediate vicinity of the northwest part of Paris, to Vanves, Meudon and Bellvue. At the first

named locality, a beautiful section of the Lower Eocene or Suessonien was examined, which displayed principally the Argile Plastique, below the thin beds of the Lignite of the *Coryphodon*, *Gastornis* and *Palæonyctis*. The whole was crowned by massive beds of the Calcaire Grossier of the Middle Eocene, with its numerous invertebrate fossils. I viewed these exposures with great interest, as the formations contain the remains of a fauna which I rediscovered in New Mexico in 1874. By this discovery I was able to identify the Wasatch horizon of the Rocky mountains with the Suessonien, thus establishing a basis for comparison of formations above and below it, a want not a little felt in North American palæontology. But how different the petrography of the Paris basin from that of North-western New Mexico. Here a thick bed of tenacious lead-colored clay is surmounted by a stratum of more or less impure lignite; in New Mexico heavy beds of hard sandstone alternate with still thicker red and yellow strata of arenaceous marl.

The Calcaire Grossier here yielded its numerous *Echini*, *Cardita planicosta*, *Nautilus*, etc. Further on, along the road towards Meudon, its softer beds formed the banks on either side. Here they were almost composed of two species of *Nummulites*, *N. lævigata* and *N. lamarckii*. Still beyond we visited one of the quarries whence had been obtained many huge blocks of the soft limestone from which so large a part of the city of Paris has been built, and to whose yielding qualities so much of the architectural beauty of the Capital of France is due. Here some of the desolating effects of the German siege were still to be observed. The lowest Suessonien, the Marnes Strontianiferes with their curious mixture of the marine and fresh water shells of the Calcaire Grossier and sands of Rilly, recently discovered, were passed as a white bank on the side of the public way. At Meudon the upper beds of the Cretaceous came in view. The contact of the Pisolitique (Mæstrichtien or Fox hills) with the Marnes Strontianiferes above, was noted as the point of separation between the Tertiary and Cretaceous series. The situation is as though the Wasatch rested immediately on the Fox Hills beds, without the intervention of the great Laramie series; although the Marnes must be regarded as lower in the scale than the lowest Wasatch yet found in North America. A fine exposure of the Chalk, with its characteristic fossils, succeeds the Piso-

litique downwards, and various characteristic fossils were found, including previously unsuspected species of the American genera *Empo* and *Saurodon*.

An agreeable feature of the occasion was a lunch offered by Prof. Chancourtois, member of the society, in his garden at Meudon, which was appreciated as such occasions generally are by hungry geologists.

The excursionists then examined the orange sands and sandstone of the Lower Miocene, at Bellevue, called the Sables de Fontainebleau, well known as the horizon of the *Halitherium*. From this point the quarries of the upper beds of the Lower Miocene, of the Meulières de Beauce, were visited. This formation, extensively distributed near to Paris, consists of red and yellow clay, filled with large siliceous concretions which contain the casts of great numbers of seeds of *Chara* and small *Lymnaeæ*. At this locality it forms the summit of a hill, from which a magnificent view of the country to the eastward is had. At its foot is the valley of the Seine, abounding in villages, villas and vineyards, and on its opposite side a range of hills bounds the horizon. The most elevated portion of the ridge bears the fort and hospital of Mount Saint Valerien.

The second excursion was to Etampes, Morigny and Jeurres, at a distance of thirty-five miles from Paris. It passed over the Miocene beds above mentioned, and visited some richly fossiliferous localities of the Sables de Fontainebleau.

The third excursion was to Maignelay, at about the same distance from Paris, where the party explored the lignites of the Suessonien, and the lowest bed of that formation, the Sables de Bracheux.

On the 9th of September the excursionists took the rail to Gournay, on the border of Normandy, from which point they passed on foot and by omnibus over a hilly and beautiful country. The region is rich and one of the most beautiful in France. The farmers have left and planted many trees, and the agriculture is of a superior character. Here under the direction of M. Lapparent, the party viewed the outcrops of the Kimmeridge, Portland, Neocomien, Greensand, Gault, and Cenomanien, and collected *Trigonia*, *Gervillia kimmeridgensis*, *Hybodus*, *Terebratula*, with numerous species of *Ostræa*, and *Exogyra*, etc. The dinner

at Gournay at the close of the day was an enjoyable event, and was enlivened with toasts and speeches.

The excursion of the 11th of September was again in the immediate neighborhood of Paris, and had for its object the examination of the famous series of the Gypsum. Passing by rail to one of the suburban stations, the party followed on foot the course of the Seine to the village of La Frette. Here a steep bank, having at a distance much the appearance of a terrace, forms the lower part of the boundary of the river valley, passing behind the village of Sarcouville and extending along the foot of the ridge which here separates the valley of the Seine from a valley immediately to the east of it. The escarpment of this ledge does not exceed twenty feet in height, but it displays a beautiful section of that part of the middle Eocene known as the Sables de Beauchamp. As it offers a good illustration of the manner in which the Tertiaries of the region of Paris are subdivided into thin beds, which represent frequent changes in the character of the water and of the sediment, I give them as explained on the spot by Dr. Vèlain. The lowest bed is a marine sandstone which becomes brackish in its superior part, and contains *Ostrea cucullaris*. Reposing on it is a limestone of lacustrine origin, containing *Lymnæa arenularia;* in a part of the escarpment this bed is wanting. It is succeeded above by a thin bed of scarcely adherent sand, containing *Melania hordacea*, and believed to have been deposited in brackish water. Above this is a stratum of compact marine limestone containing *Cytherea elegans* and *Potamides*. A lacustrine limestone called the Calcaire de Ducy rests on the marine limestone. This bed repeats the second bed of the series in the possession of the *Lymnæa arenularia*, the specimens presenting a slight varietal difference. It is this formation which contains the oldest remains of *Palæotherium*, as I was informed. In the locality described, the soil of the ascending face of the hill conceals higher beds from view, so that it became necessary to pass to other localities in order to study them.

The party accordingly ascended to the crest of the water shed, passing through orchards and vineyards on its slope. The apples were abundant, but not of good quality. On the summit stood a ruined windmill, forming a landmark, and near it a restaurant and cafè commanding a beautiful view of the rich and populous valley on its north-east side, and of the hills beyond. From this

point our route lay again through vineyards and low forest, and along a public highway. Here piles of the meuliéres of the Lower Miocene of Beauce, containing myriads of *Charæ* and *Lymnaeæ*, with the solid bed of the road, testified to the value of this material as a macadamizer. At length we reached the part of the hill which overlooks Sannois, and descending, examined a complete and beautiful exposure of the gypse and other strata of the Upper Eocene. On the most elevated ground we had the Meuliéres de Beauce, and then in the descending order, the Sables de Fontainbleau with *Cytheræa incrassata*, and *Ostrea scitula*. Then a greenish bed of strontianiferous marl, and below it a few feet of clay containing gypsum crystals and fish bones, with *Cyrena convexa*. This stratum terminates the Lower Miocene, resting on a lacustrine bed which is referred to the Eocene. It consists of marl and soft limestone containing *Lymnæa strigosa*, from which shell it takes its name. With it occur the vertebræ of birds and remains of *Xiphodon gracilis*, which belongs especially to this horizon. The *Lymnæa strigosa* marl lies immediately on the gypsum, of which the escarpment at the quarries of Sannois is about one hundred feet in elevation. The material of this celebrated deposit differs from that of Nova Scotia, Virginia and New Mexico, in its waxy color and coarse fracture. Its continuity is interrupted by two beds of white limestone of no great thickness, and at its base is found a heavier bed of marine origin containing *Pholadomya ludensis*. This in turn rests immediately on the "Calcaire de St. Ouen," which is followed in descending order by the Calcaire de Ducy. This was the superior member in the section of La Frette already mentioned, so that with this junction we completed the series of the Upper, and a large part of the Middle Eocene, with much of the Lower Miocene. To connect fully the Middle and Lower Eocene was the work of another excursion, viz: that to Compiégne. From the upper part of the gypsum, at Sannois, I had the gratification of obtaining portions of both jaws, with teeth, and several bones of a *Palæotherium medium*.

Compiégne is a small town at a distance of about a two hours' ride to the north of Paris, on the Northern railway. It is situated on the border of the forest of the same name, and was the favorite autumn residence of Napoleon III. The excursion passed by public conveyance for about two hours through the

forest to Pierrefonds, on the opposite side. This place is a large village, and is celebrated for its immense chateau which stands in the middle of the town. It dates from the fourteenth century, and was restored during the late superintendency of M. Viollet le Duc. From this point the excursion passed on foot, accompanied by the carriages, entirely through the forest in a new direction. The general inferiority of the timber in size and variety, to that to which the American is accustomed at home, was very obvious. It protects several species of deer and numerous wild boars. Wolves are said to be still found there, and I was informed that they had considerably increased in numbers during the late war with Germany.

Between the Calcaire Grossier and the series of the Suessonian or Lignite and Argile Plastique, is an extensive series of sands and sandy marls which are not present in the exposure seen at Vanves during the first excursion. They are called the Sables de Cuise and are referred to the upper part of the Lower Eocene or Suessonian. The present excursion had for its object the examination of this formation. We first found it in banks on the road side, where great numbers of *Cerithia*, *Turritellæ*, etc., lay exposed. Our collectors could hardly leave these for a small quarry off the road, where incredible numbers of these shells, with *Carditæ*, *Solaria*, *Trochi*, *Neritinæ*, *Dentalia*, etc., etc., covered the mounds that stood around or could be sifted from the banks. This is one of the classic localities to which, as to many others visited by these excursions, the palæontologist turns with something like reverence, as the sources of our first knowledge, and hence the standard of comparison for later times and other countries; in fine, as the field of the daily labors of the fathers of palæontology, Lamarck, Deshayes, Cuvier and De Blainville.

Leaving this attractive locality, the excursionists passed to some high banks of sand bordering other roads. This stratum is one of the lower members of the Middle Eocene or Calcaire Grossier in the wide sense. Here we found abundant teeth of sharks, *Oxyrhina*, *Lamna*, *Otodus*, etc., with spines of *Myliobatis*. We soon after took our carriages for the return to Compiégne, which we reached in time for dinner. Our arrival in Paris was late in the evening.